A red square icon with a white border, located in the top left corner of the slide.

SKP32C

Tutorial 2

Creating A New Project Using HEW

Overview

This tutorial describes the steps in creating new projects for the M32C using two different methods.

The first method uses the SKP project generator, that will create an empty project.

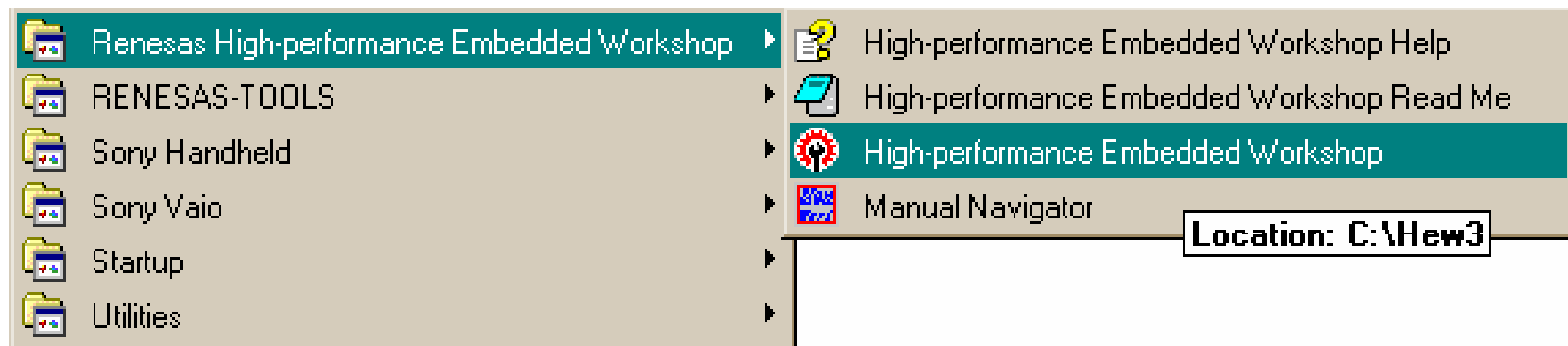
The second method will provide step by step instructions on creating a project with existing source files.

To get the most out of the SKP including the development tools, check out the references at the end of this tutorial.

Note: *This tutorial assumes the user has done the following:*

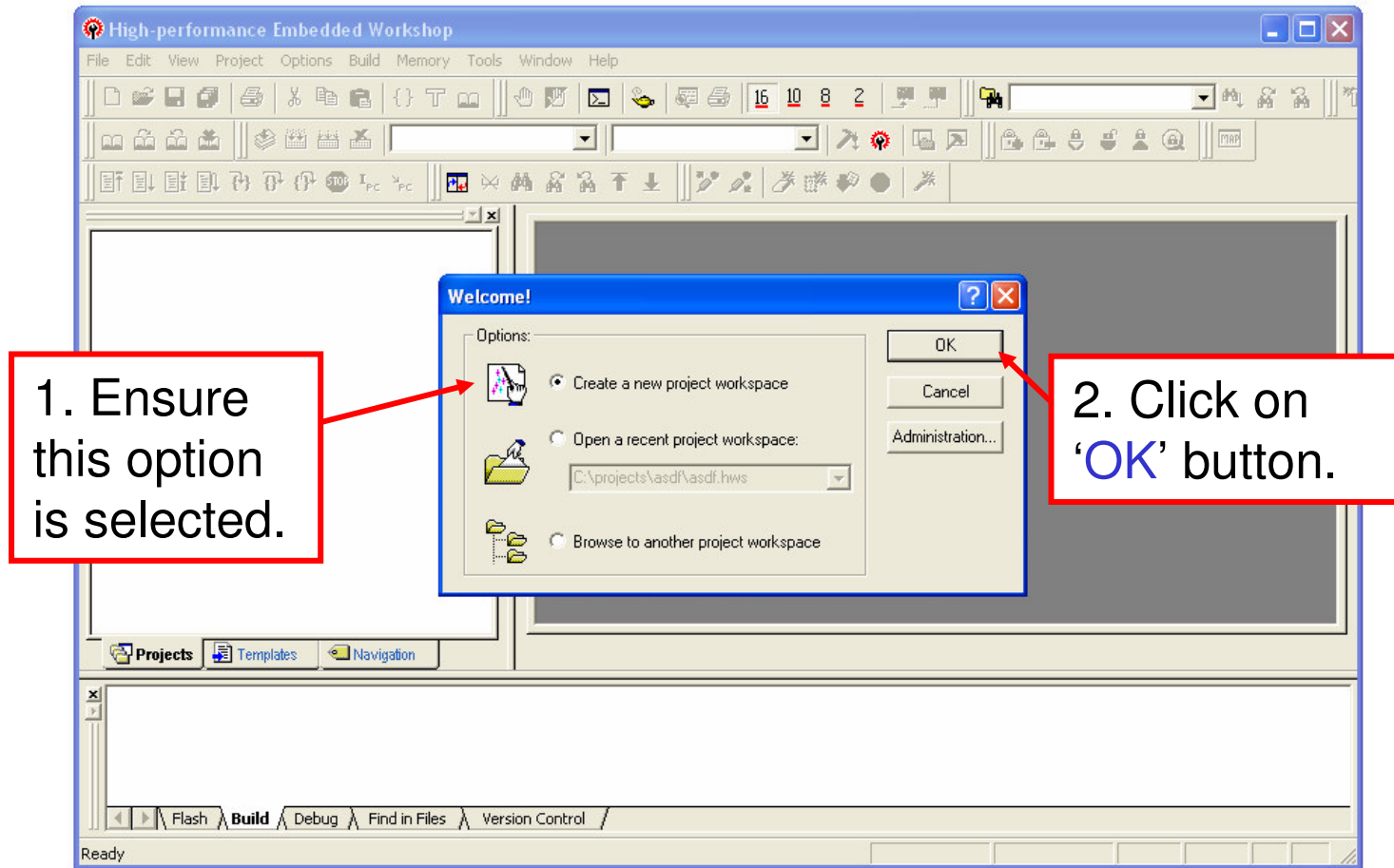
1. *Followed the 'Quickstart Guide'*
2. *Installed the SKP files, examples, and software tools in the default directories.*
3. *Reviewed Tutorial 1.*

Starting HEW



From the Windows Start menu, click on
**Programs > Renesas High-performance Embedded Workshop>
High-performance Embedded Workshop**

Creating a Project Workspace



When HEW starts up, you will be prompted to select a workspace. By default, 'Create a new project workspace' option is selected.

Creating a New Project with the SKP project generator (1/4)

The screenshot shows the 'New Project Workspace' dialog box. On the left, under the 'Projects' tab, a list of project types is shown: 'Application', 'Empty Application', 'Import Makefile', 'Library', and 'M32C/85 Starter Kit Plus'. The 'M32C/85 Starter Kit Plus' option is selected and highlighted. On the right, there are several input fields: 'Workspace Name' with 'Tutor2_pg', 'Project Name' with 'Tutor2_pg', 'Directory' with 'C:\HEW3\Tutor2_pg', 'CPU family' with 'M16C/80,M32C', and 'Tool chain' with 'Renesas M32C Standard'. At the bottom are 'OK' and 'Cancel' buttons. Red arrows point from numbered text boxes to these specific elements in the dialog.

1. Select 'M32C/85 Starter Kit Plus' as the project type.

2. Enter 'Tutor2_pg'.

3. Select M16C/80,M32C.

4. Verify Renesas M32C Standard is selected.

Note: This is the directory where the project will be created, 'C:\HEW3\Tutor2_pg'.

5. Click on 'OK' button.

Creating a New Project with the SKP project generator (2/4)

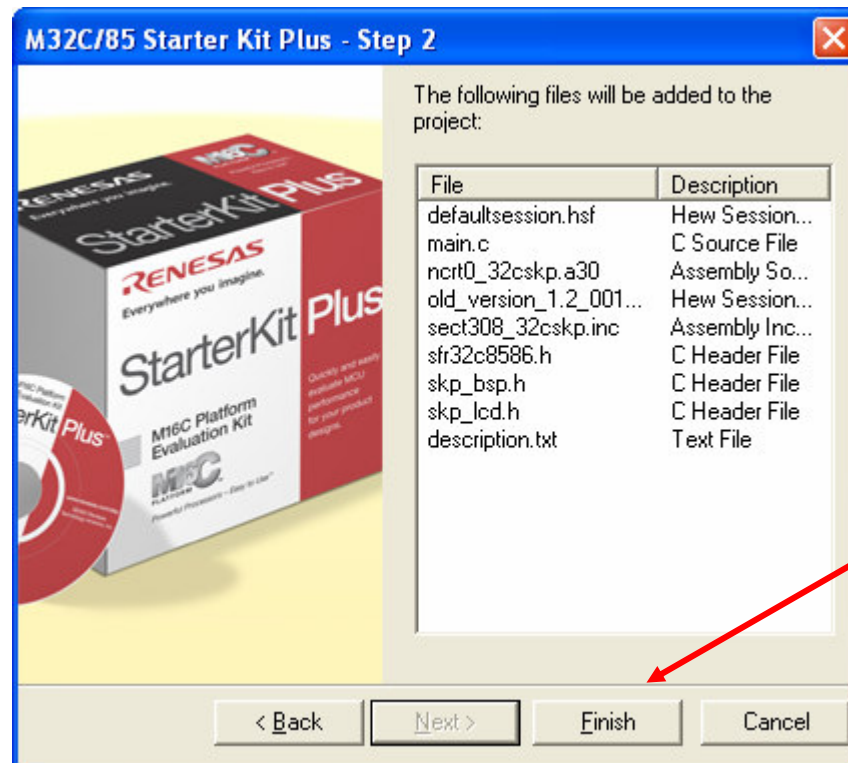


1. Select 'Empty Project'.

2. Click on 'Next' button.

Note: The other project selections (Verify SKP and Sample Code) allow you to test the SKP and evaluate the MCU peripherals and features using pre-built sample code.

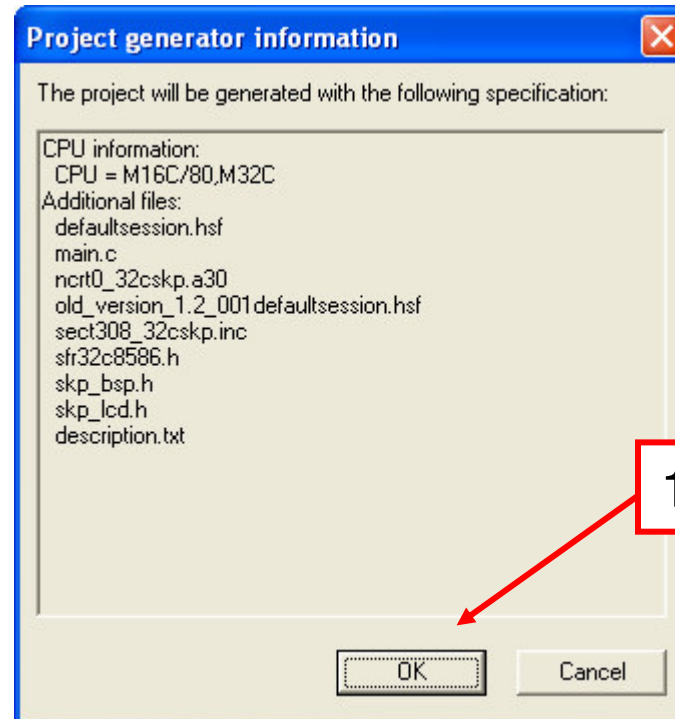
Creating a New Project with the SKP project generator (3/4)



1. Click on 'Finish' button.

Note: Step 2 shows all the files that will be added to the new project and their description.

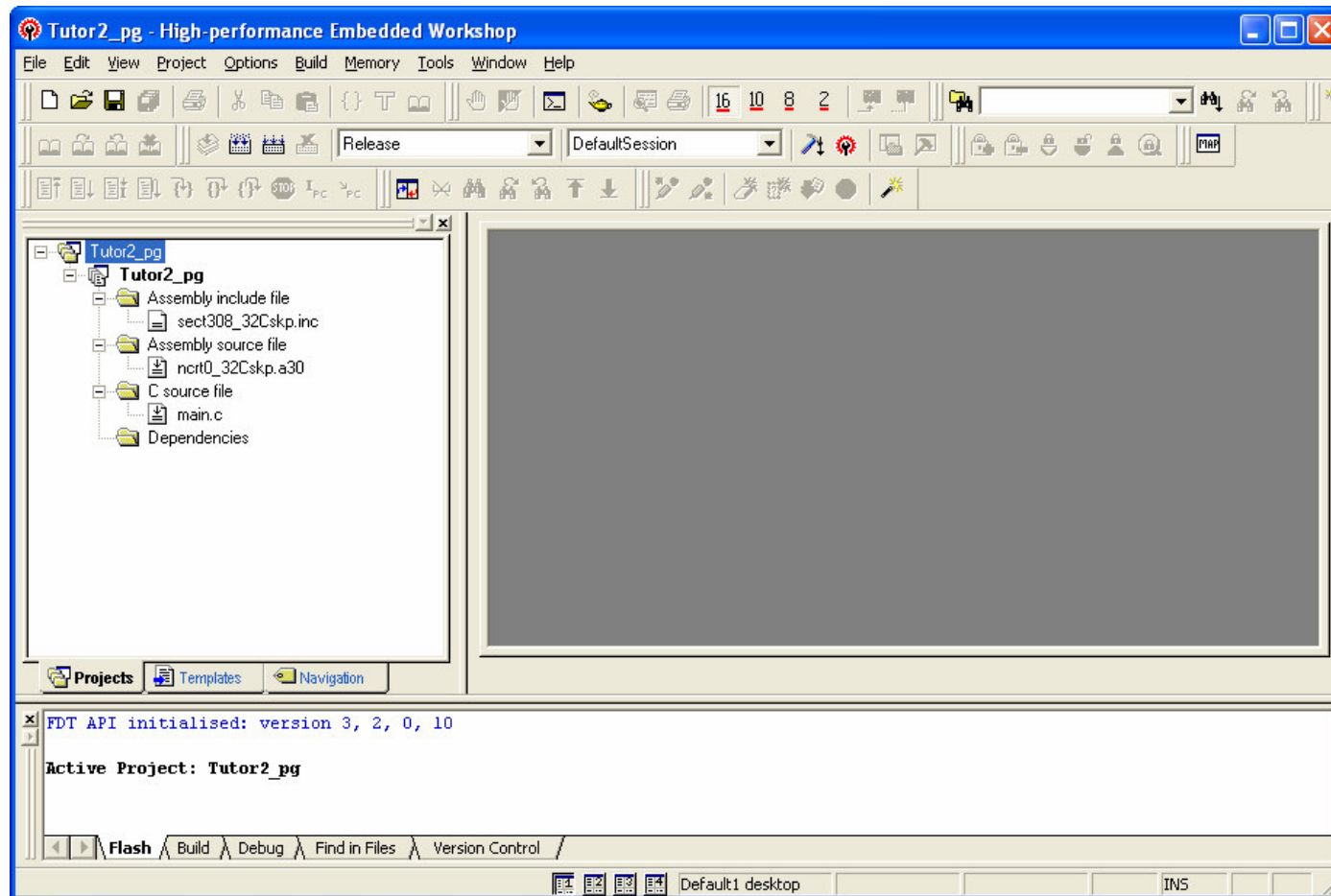
Creating a New Project with the SKP project generator (4/4)



1. Click on 'OK' button.

The project generator information is shown once the project has been created.

HEW after Creating a New Project using the SKP project generator



SKP project generator

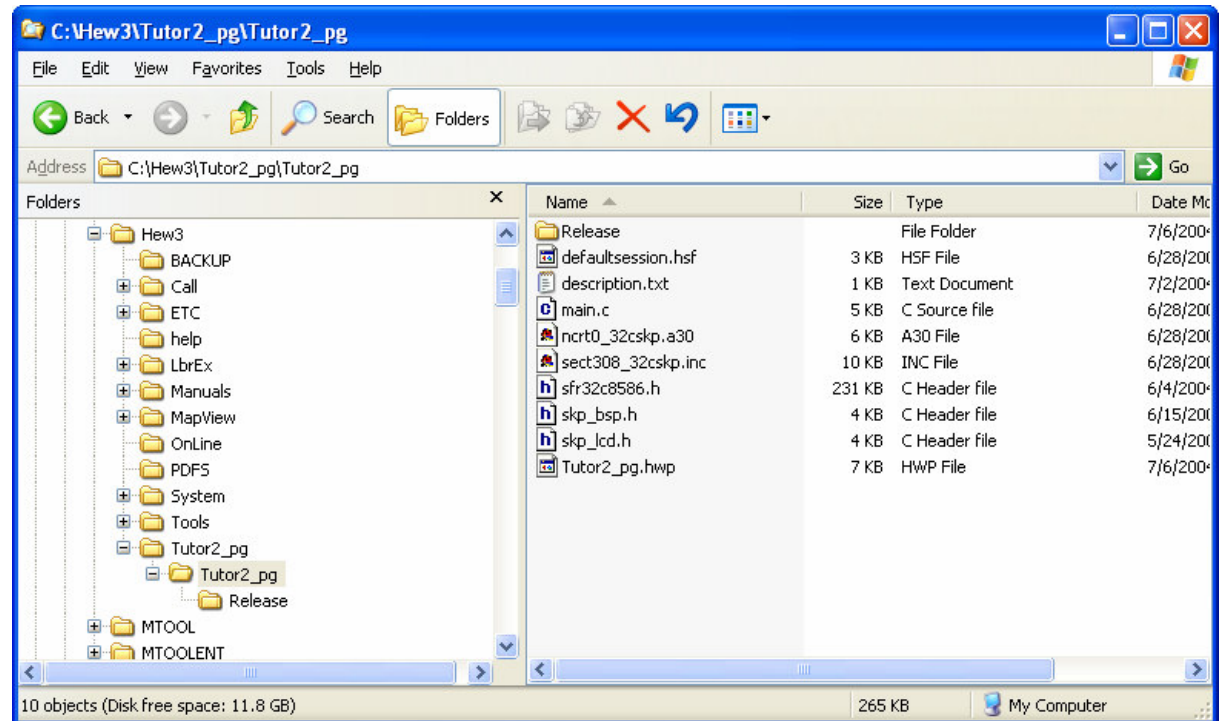
Summary (1/2)

The following is a summary of what happens when creating a new project using the SKP project generator Empty Project:

1. The following files are created in the workspace or project directory (in this example, under C:\Hew3\Tutor2_pg):
 - A copy of the user startup ([ncrt0_32Cskp.a30](#) and [sect308_32Cskp.inc](#)) files.
 - A .c file ([main.c](#)) that contains the main function.
 - Copies of the SKP header files ([sfr32c8586.h](#), [skp_bsp.h](#), and [skp_lcd.h](#)) included in the .c file.
2. Links the startup files first as shown in the “Linking the startup files first” slides (slides 25 & 26).
3. Configures the external debugger to launch KD3083 as shown in the “Launching KD3083 from HEW” slide (slide 28).
4. Adds the phase to generate a mot file when building a project as shown in the slide “Generate a mot file for the Programmer” (slide 29).

SKP project generator Summary (2/2)

The project structure and files created when using the SKP project generator are shown here.



Creating a New Project Environment

The SKP project generator simplifies several steps in creating a new project but what if you already have source files? The following slides will walk you through the following:

- Creating a new workspace from scratch
- Adding source files
- Setting up the software development environment including linker, build, debugger, and programming configuration.

Creating a New Project (1/8)

Select 'New Workspace' from the File menu...

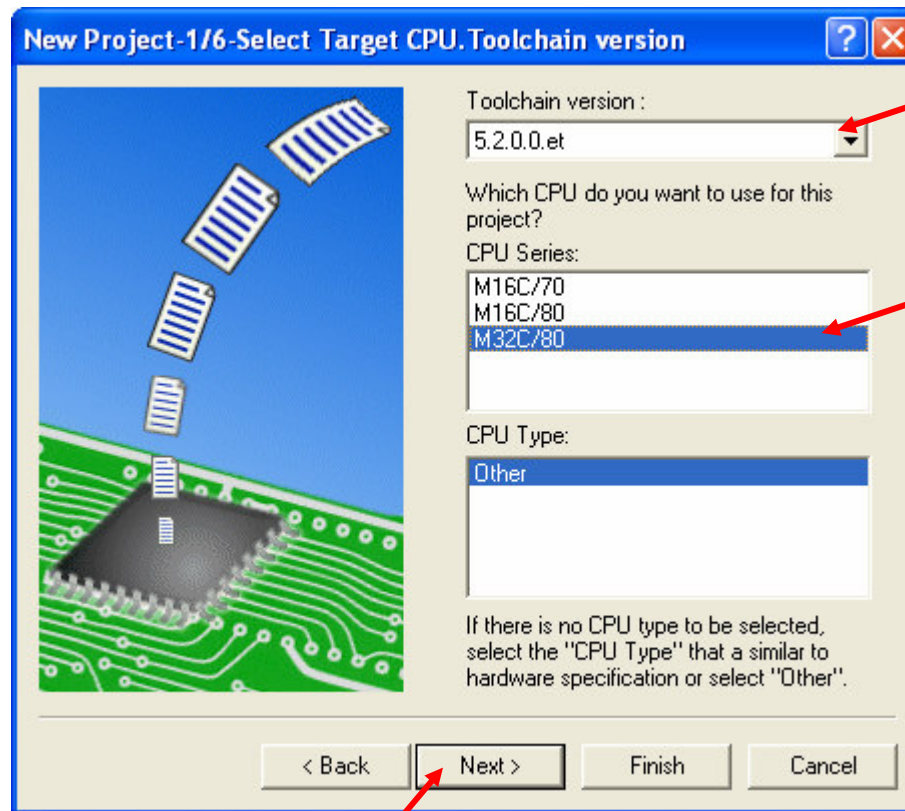
The screenshot shows the 'New Project Workspace' dialog box with the following fields and options:

- Projects:** A list on the left with 'Application' selected.
- Workspace Name:** A text field containing 'Tutor2'.
- Project Name:** A text field containing 'Tutor2'.
- Directory:** A text field containing 'C:\MTOOL\SKP32C85\Sample_Code\Tutor2' with a 'Browse...' button to its right.
- CPU family:** A dropdown menu with 'M16C/80.M32C' selected.
- Tool chain:** A dropdown menu with 'Renesas M32C Standard' selected.
- Buttons:** 'Properties...', 'OK', and 'Cancel' at the bottom.

Numbered instructions with arrows pointing to the corresponding elements:

1. Select 'Application'.
2. Browse to or enter 'C:\MTOOL\SKP32C85\Sample_Code'
3. Enter 'Tutor2' as name of the project.
4. Leave as is (i.e. 'Tutor2').
5. Select M32C.
6. Verify Renesas M32C Standard is selected.
7. Click on 'OK' button.

Creating a New Project (2/8)

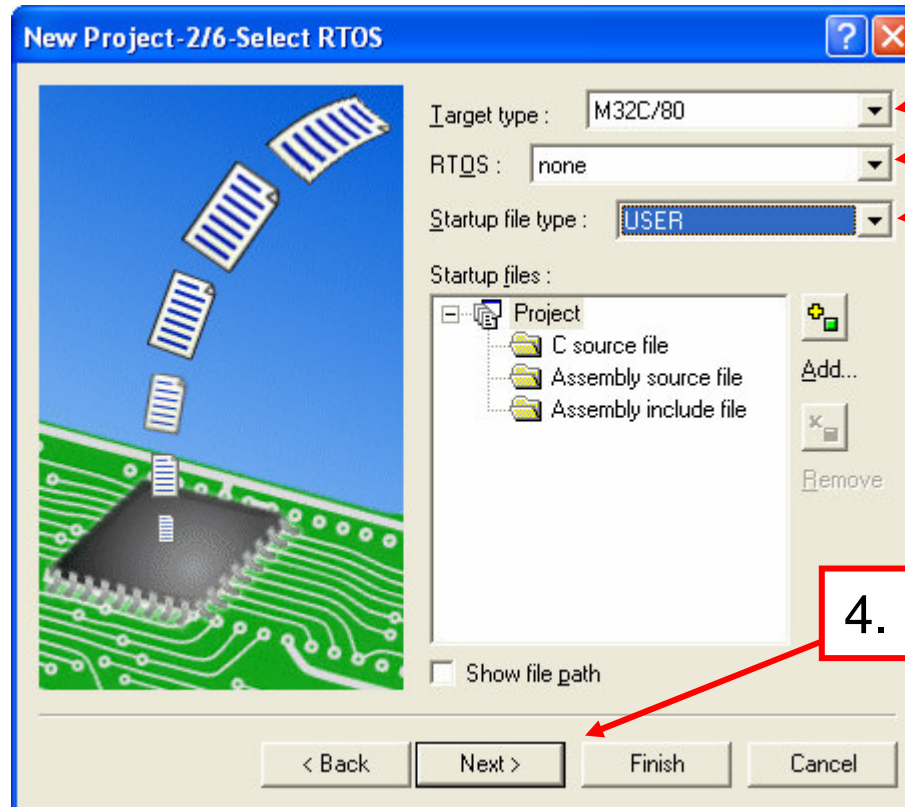


1. Leave as is.

2. Select
'M32C/80'.

3. Click on 'Next' button.

Creating a New Project (3/8)

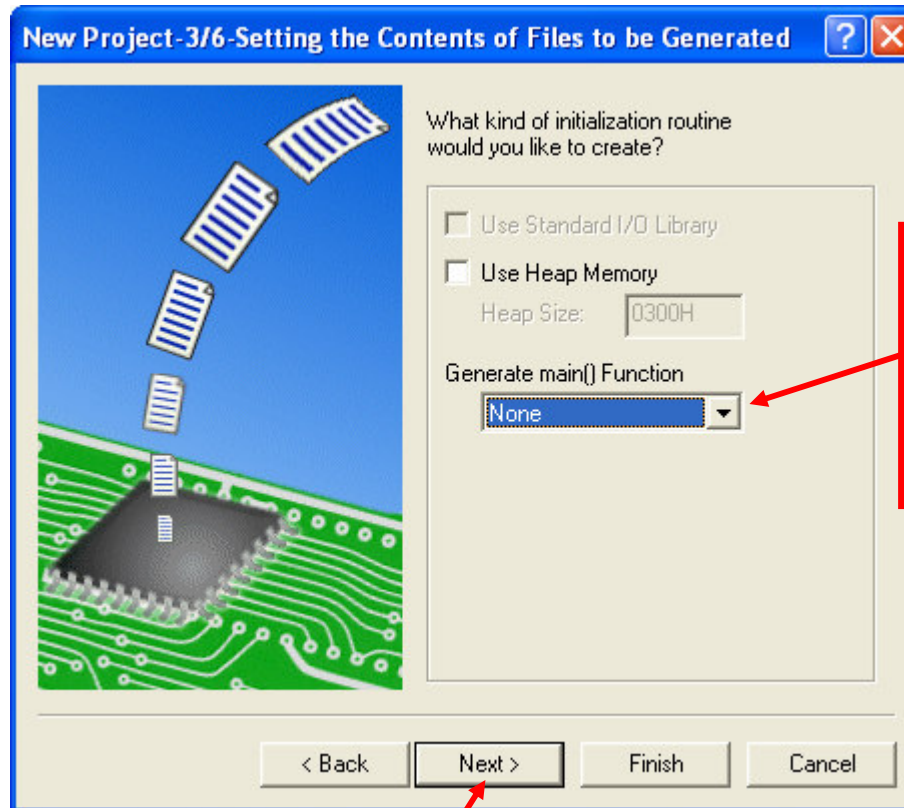


1. Select '**M32C/80**'.
2. Leave as is.
3. Select '**USER**'¹.

4. Click on '**Next**' button.

Note: 1. Differences between Default and USER Startup files is discussed after the project is created.

Creating a New Project (4/8)

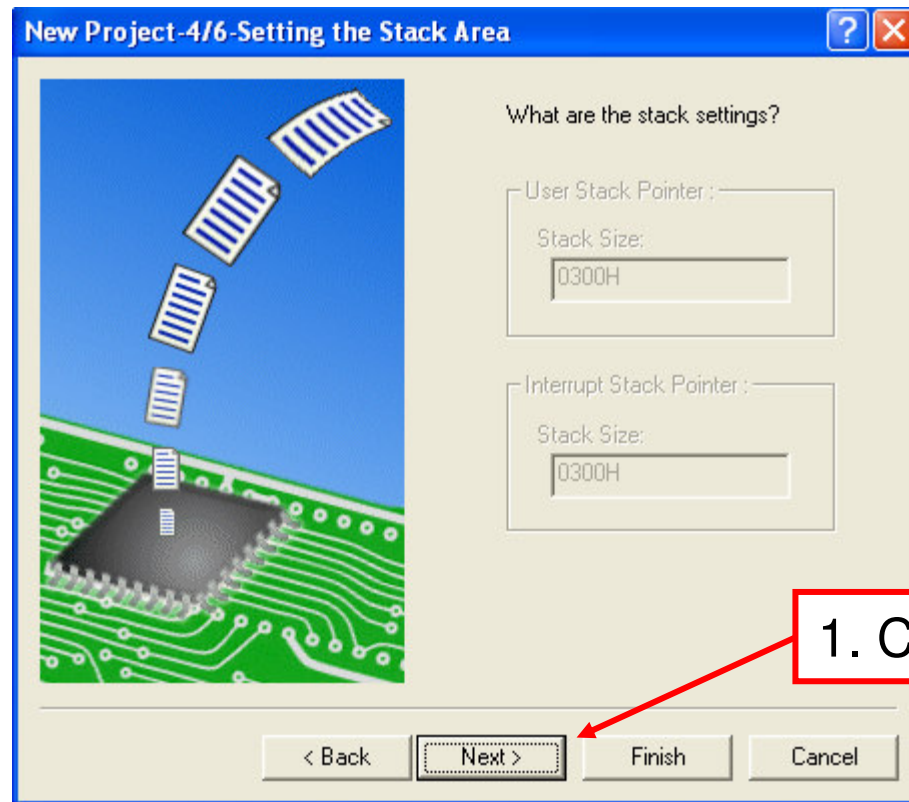


1. Select '**None**' as we already have a file with the main() function.

2. Click on '**Next**' button.

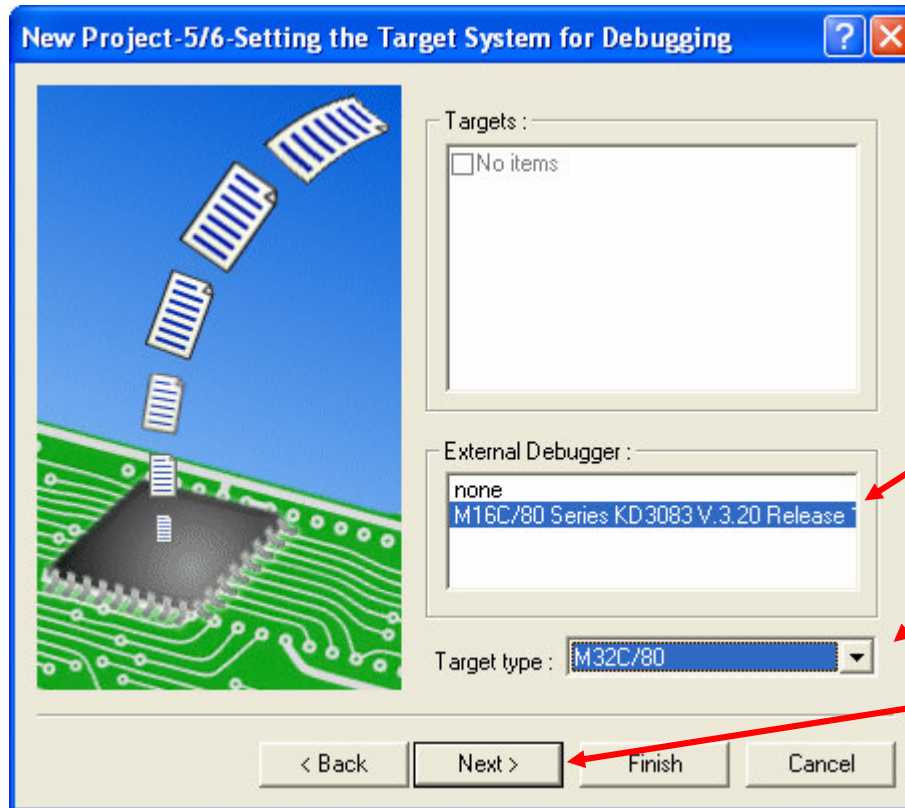
Creating a New Project (5/8)

The stack settings are grayed out because USER startup file was selected (see Creating a New Project 3/8). If DEFAULT startup file was selected, these settings become available.



1. Click on 'Next' button.

Creating a New Project (6/8)



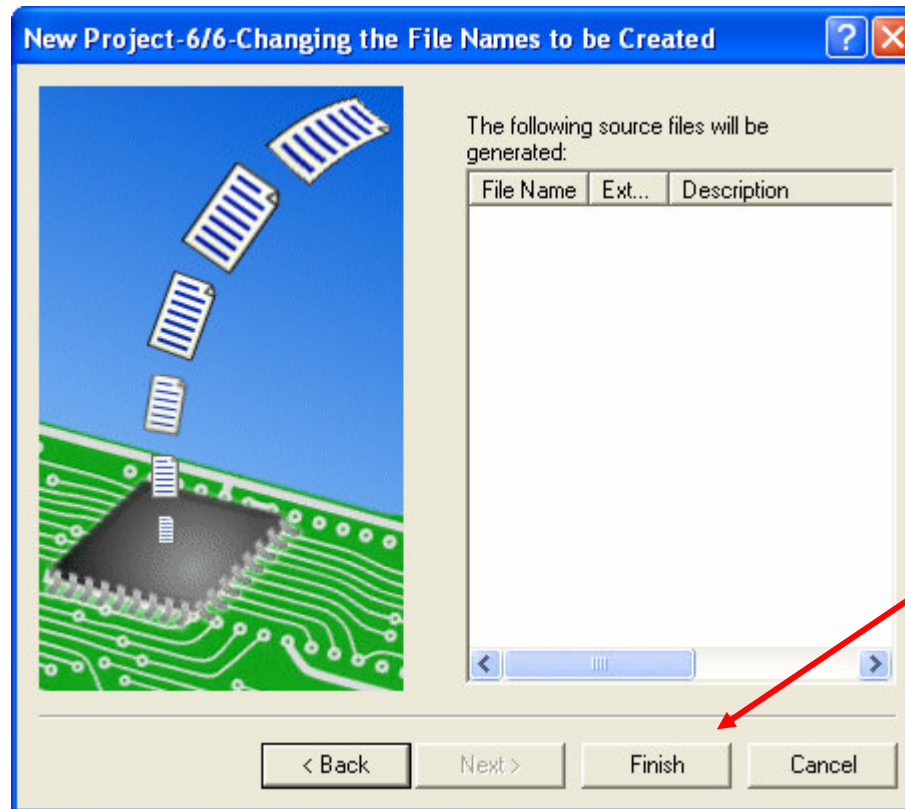
1. Select 'KD3083'.

2. Leave as is.

3. Click on 'Next'.

Creating a New Project (7/8)

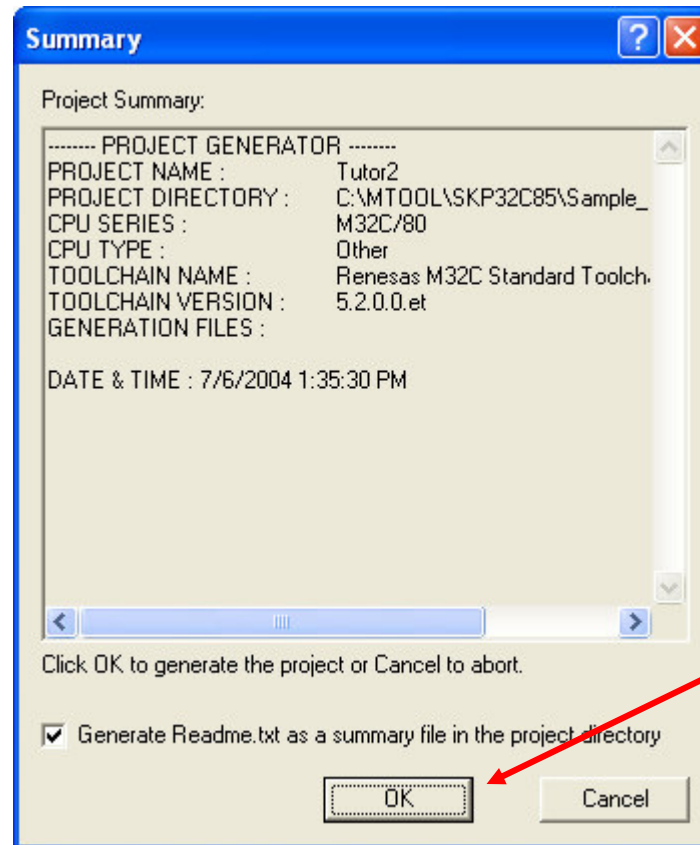
We already have the source files and selected USER startup files (see Creating a New Project 3/8 and 4/8) and so, there are no source files that will be generated.



1. Click on 'Finish' to complete project creation process...

Creating a New Project (8/8)

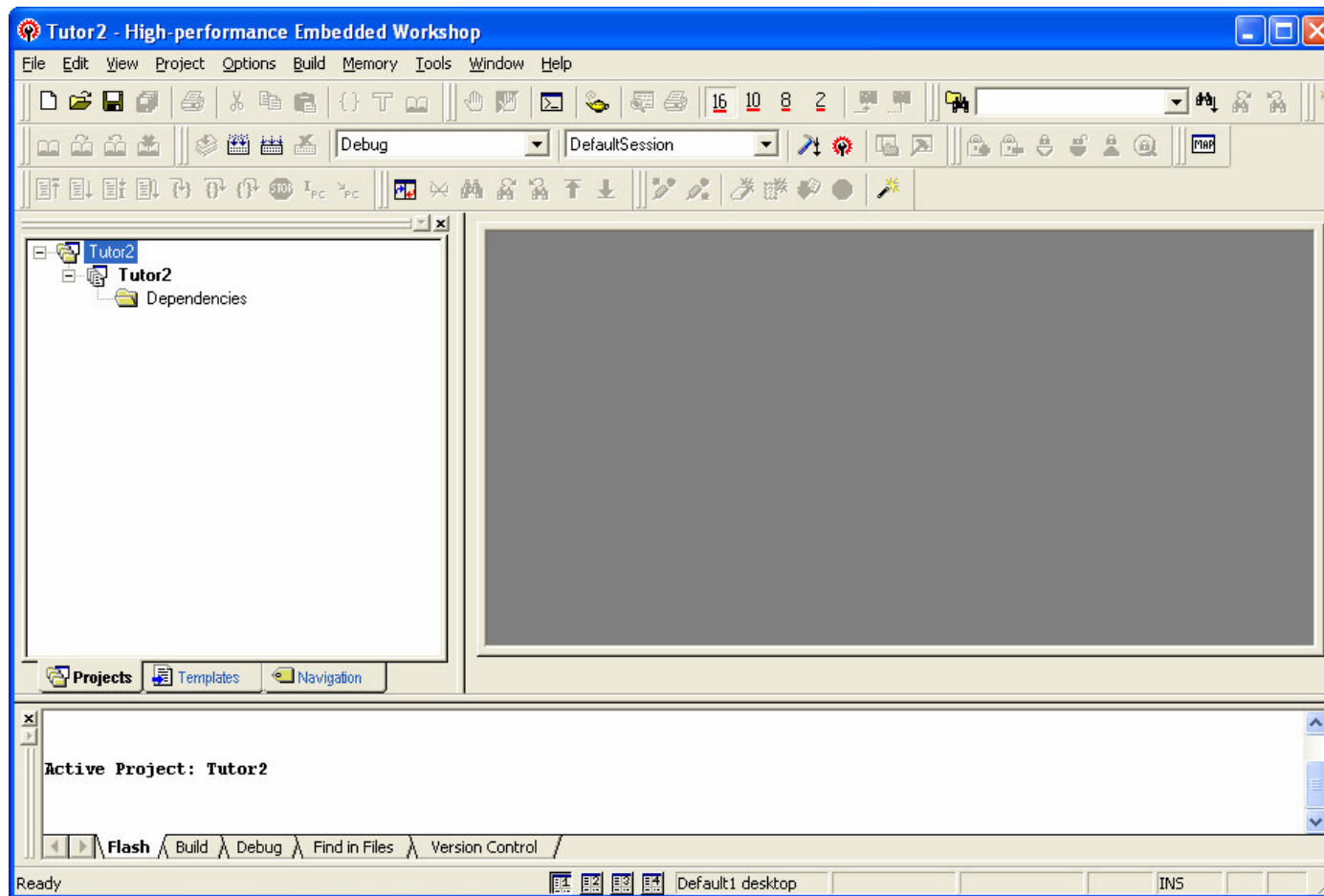
A project summary is displayed to indicate a successful creation of the new project, tutor2.



1. Click on 'OK'.

HEW

After creating the project, HEW will look similar to the figure below.



Default and User (SKP) Startup Files

Except for comments, the differences between the default (*ncrt0.a30* and *sect30.inc*) and user (*ncrt0_32Cskp.a30* and *sect308_32Cskp.inc*) startup files are listed below:

Ncrt0.a30

- BCLK – Set to **f1** (div by 1) of Xin (BCLK = Xin frequency) in user file.
- Stack sizes – Smaller (**0x100**) in user file [default at 0x300].
- Heap size – **0** (no heap size) in user file.
- Vector Base Address – **0xFFFF800** for (M32C/85) in user file [default at 0xFFD00 (M16C/62)]
- Section Allocation – **Calls user sect30 file (sect308_32Cskp.inc)** [default calls default sect30.inc].
- Standard I/O Initialization – **No initialization** in user file (done using mcu_init from main()) [default file calls _init routine].

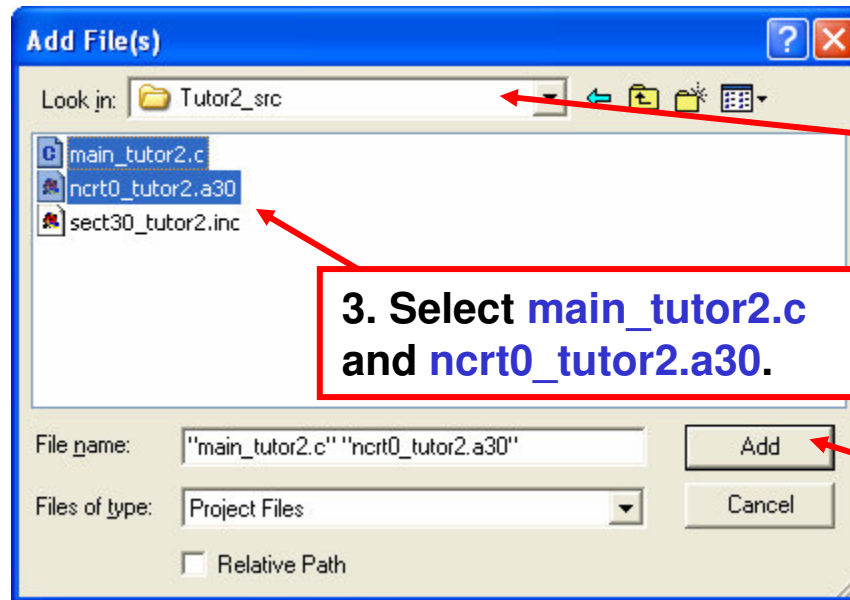
Sect30.inc

- Variable Vector Definition – Simplified and described in user file

Note: *You can use the default startup files but ensure that you understand the how to make the necessary modifications. The customized startup files for the SKP can be found under **C:\MTOOL\SKP32C85\Sample_Code\Startup_files** directory.*

Adding Source Files (1/2)

1. From HEW's **Project** menu, select **Add Files** and the Add Files dialog box is displayed.



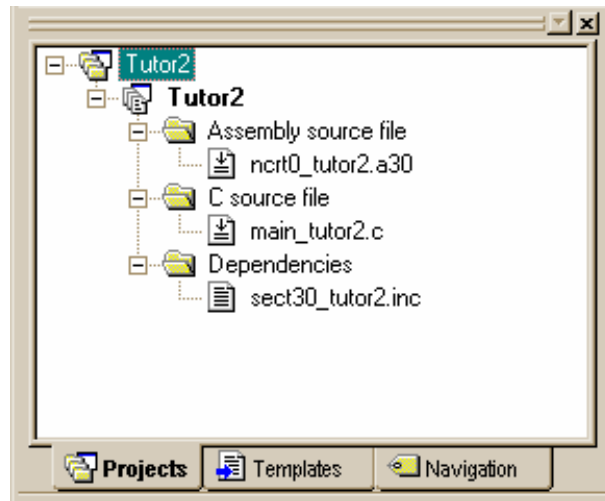
2. Browse to **C:\MTOOL**
\SKP32C85
\Sample_Code\Tutor2_src
folder, which contains the
source codes for this
tutorial.

3. Select **main_tutor2.c**
and **ncrt0_tutor2.a30**.

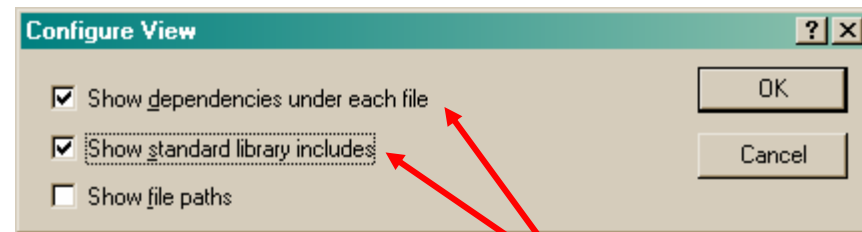
4. Click on **Add**.

Adding Source Files (2/2)

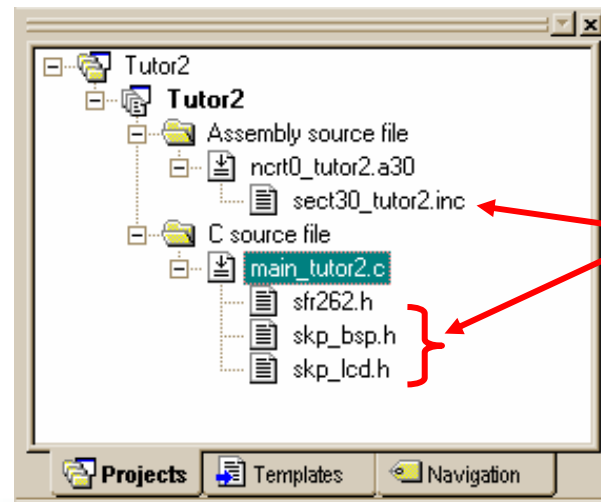
After adding source files, HEW's workspace will look like the figure below.



1. To display dependencies per source file, right-click on the Workspace window, and click on the **Configure View**.



2. Click on check boxes in Configure View dialog box.
3. Click on **OK** button.



Displaying the source file dependencies this way makes it easier to verify if the header files are included before building the project.

Linking the Startup File First (1/2)

After checking dependencies, NC308 must be setup to compile and link the startup files first. The startup files contain information on memory addresses and sections which the linker uses to place the code at the correct addresses.

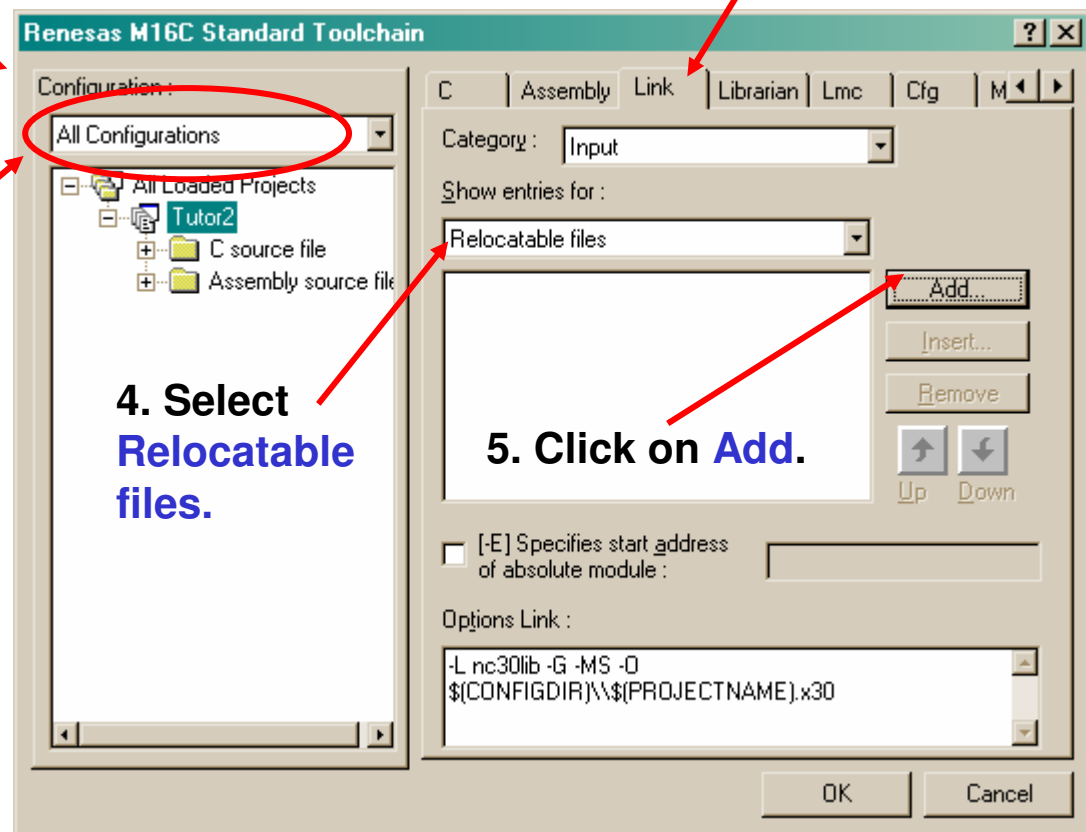
- 1. Select **Renesas M32C Standard Toolchain** from the **Option** menu and this window is displayed.**

- ## 2. Select All Configurations.

- 3. Click on [Link](#) tab.**

- #### 4. Select Relocatable files.

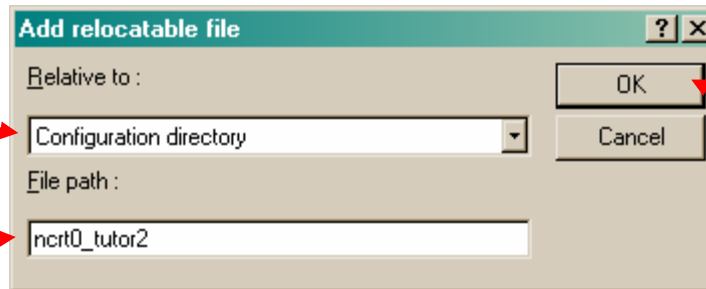
- 5. Click on Add.**



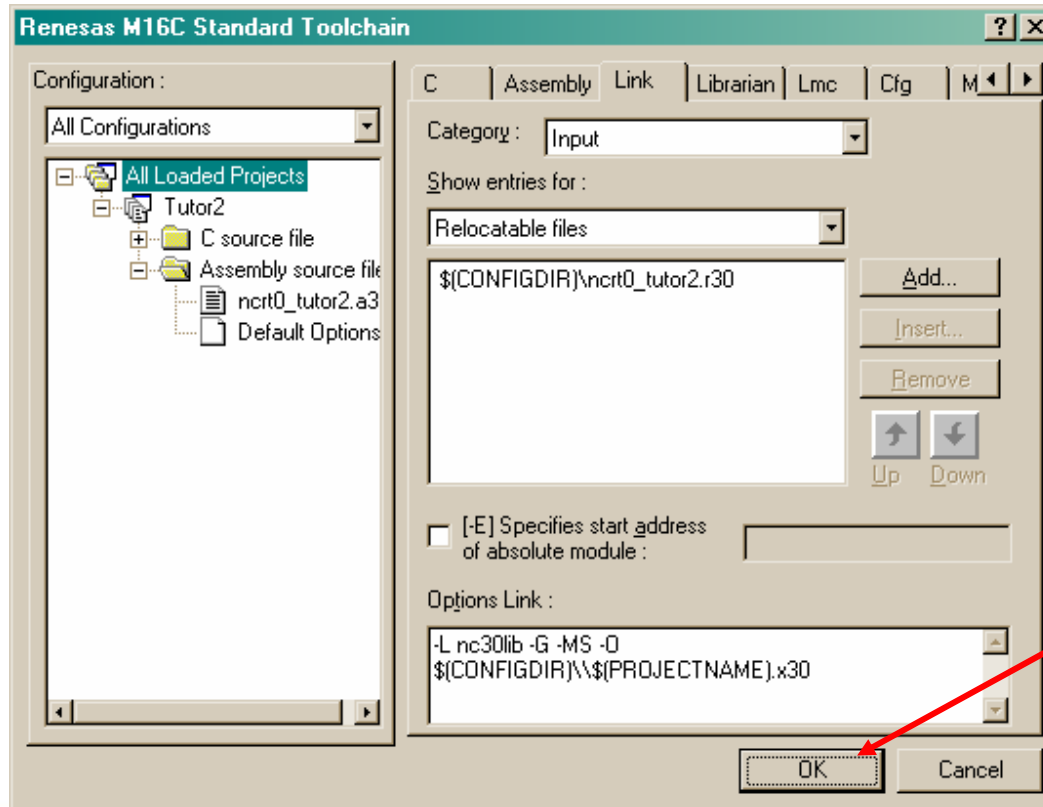
Linking the Startup File First (2/2)

1. Select **Configuration directory**.

2. Enter the startup source file, i.e. **ncrt0_tutor2**.



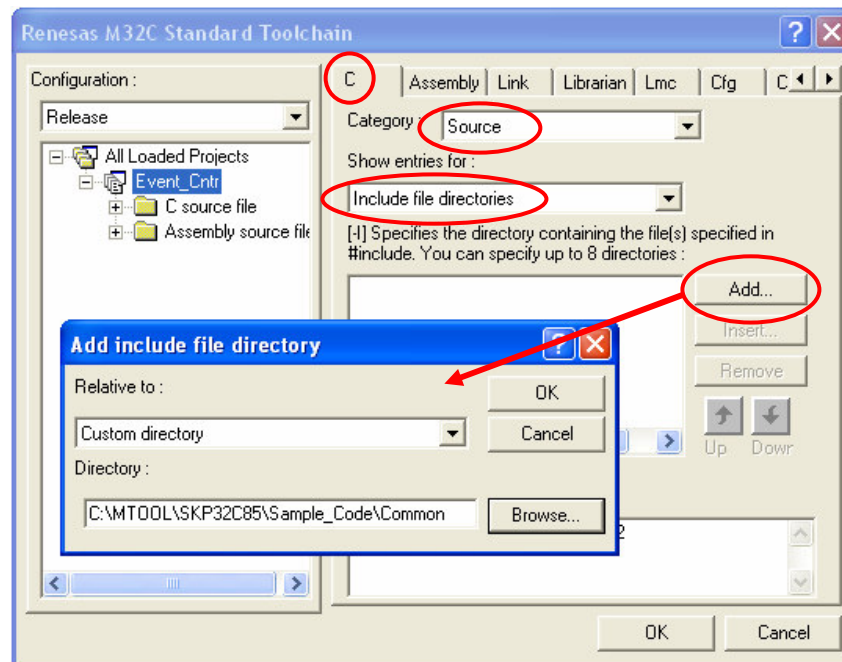
3. Click on **OK**.



4. Click on **OK**.

Defining an Include Directory

For this SKP, files that are common to all the sample code are kept in a directory named “\Common” under \Sample_Code. An example is the register definition file sfr.h that is included for all the projects, yet never needs to be modified. Because of this, we will need to setup up in HEW how to instruct the compiler where to look for these files during compile time.

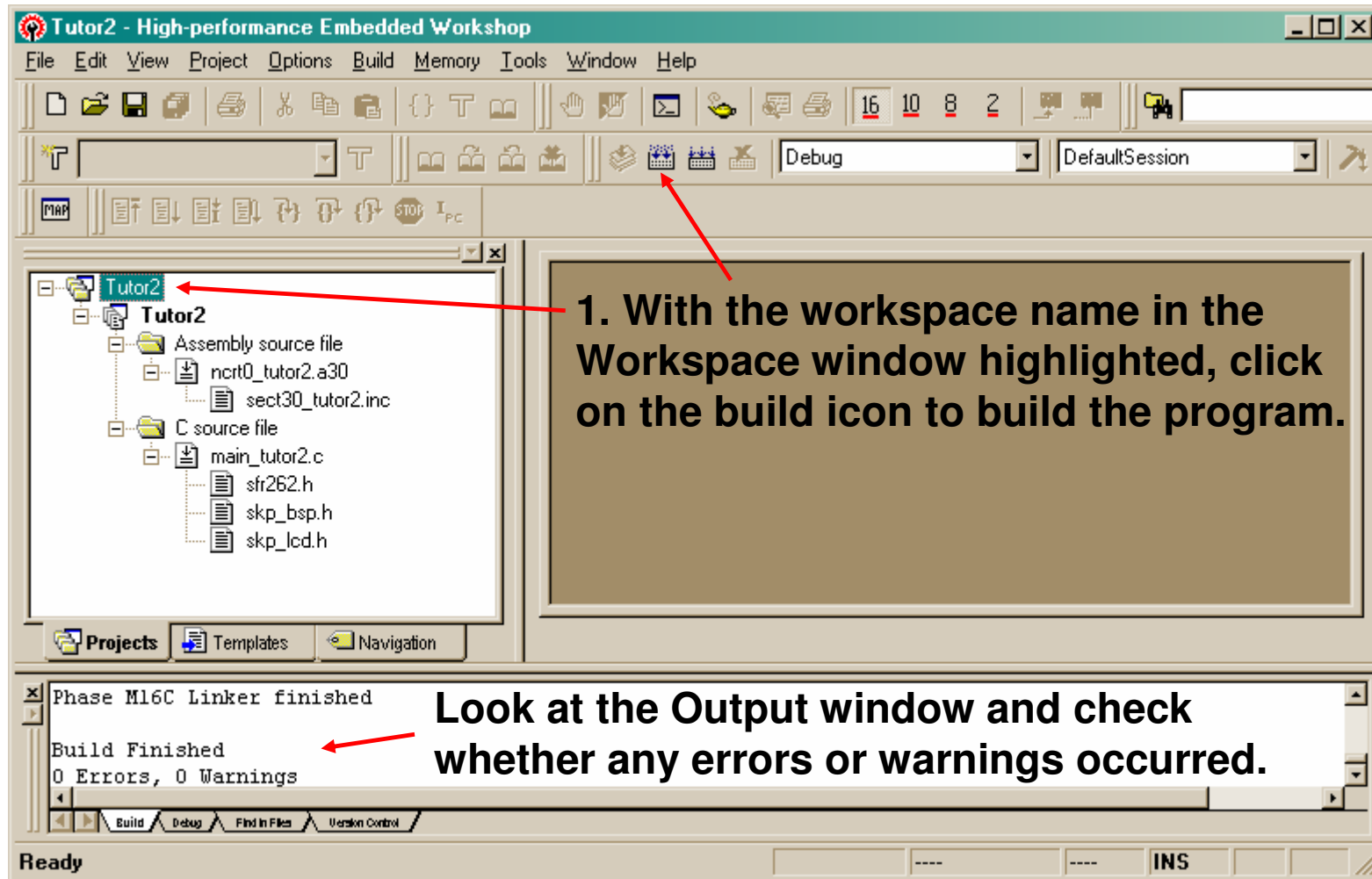


1. Select **Renesas M32C Standard Toolchain** from the **Options** menu and this window is displayed.

2. Click the **Add...** button.

3. Set the “Relative to:” option to **Custom directory** and the “Directory:” to the location of your Common directory for your SKP.

Building (compile & link) the Program



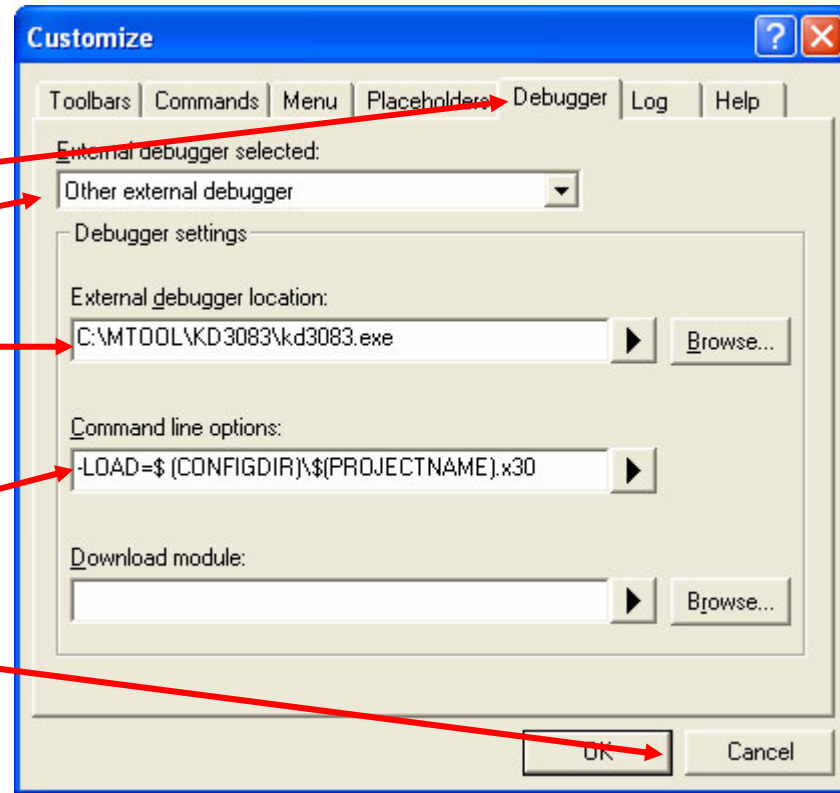
If there are no errors, you can try running the program on the SKP16C26 Board using the ICD and KD3083 Debugger.

Launching KD3083 from HEW

KD3083 can be launched directly from HEW, but HEW must be configured as shown below.

1. Select **Customize** from from the **Tools** menu.
2. Click on **Debugger** tab
3. Select **Other external debugger**.
4. Locate **KD3083** from **C:\MTOOL\KD3083** folder.
5. Enter **-LOAD=\$ (CONFIGDIR)\\$(PROJECT NAME).x30**.
6. Click on **OK**.

To launch (and download .x30 file) KD3083, click on this icon.



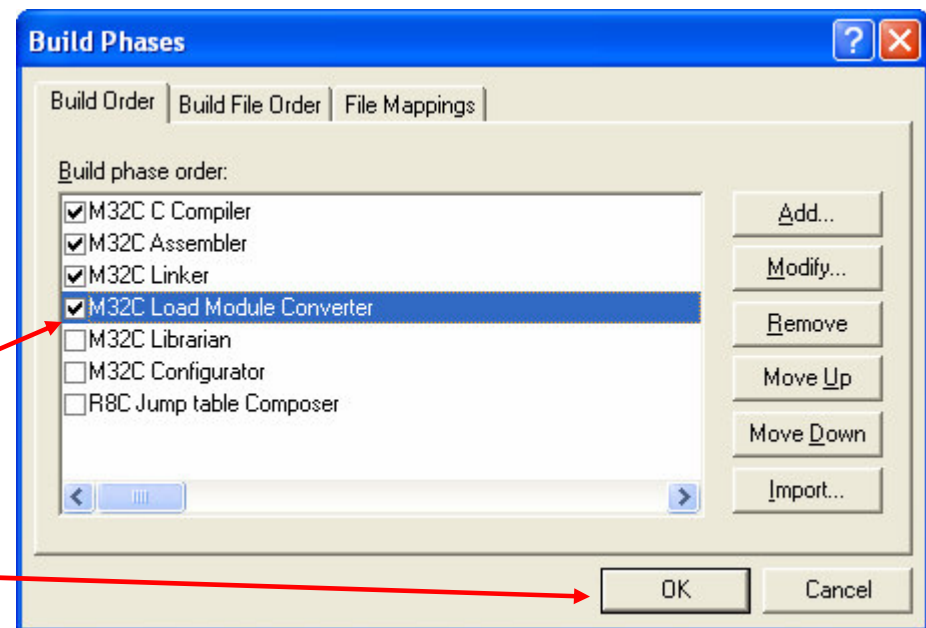
Generate a mot file for the Programmer

After building a program, a file with an **.x30** is generated. For this example, '**tutor2.x30**' is generated. This **.x30** file can be downloaded using KD3083. However, device programmers, including the FoUSB Programmer, use hex files in Motorola or Intel format.

1. To generate a hex file during the build process, select **Build Phases** from the **Option** menu.

2. Click on **M32C Load Module Converter** checkbox.

3. Click on **OK**.



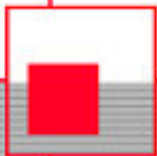
With the feature enabled, a hex (**.mot**) file is created when building the project. Look for a **Tutor2.mot** file under **C:\MTOOL\SKP32C85\Sample_Code\Tutor2\Tutor2\Debug** folder.

End of Tutorial 2

This is the end of the tutorial. You can try modifying or downloading other sample programs from the \Sample_Code directory.

Be sure to check out the references on the following pages.

Have Fun!!



References and Recommended Reading

All documents that came with the SKP can be found using the “Document Description” from the Start > Programs > Renesas-Tools > SKP16C26 menu.

- **SKP32C8x User's Manual:** This document provide details on the Starter Kits.
- **HEW User's Manual:** To fully understand and get the most out of HEW, this is recommended reading.
- **KD3083 Help:** The tutorial only covered the basics of KD3083. Check out the Help menu to find out all of KD3083's features.
- **NC308 User's Manual:** Check this manual out for features specific to the NC30 compiler.
- **M32C83,85 Hardware Manual:** M32C/8x device specifications.
- **RTA-FoUSB-MON User's Manual:** Provides details on the In-Circuit Debugger and Flash over USB Programmer.

References and Recommended Reading

- **M32C Series C Language Programming Manual:** This is a great document for any level of programmer. The first chapter is an introduction and reference on the C language. The next chapter explains specifics of C programming with the M16C/80,M32C microcontroller.
- **M32C Series Software Manual:** This document describes the instruction set and timing information for the M16C/80,M32C series CPU cores.
- **AS308 Version X.XX User's Manual:** Read this manual if you plan on writing programs in Assembly or when making changes to the startup file.
- **Application Notes and Sample Programs:** Application notes and other sample programs can be accessed from Renesas Technology America's website: <http://www.renesas.com>.

